#3/Priority Document

11/3/03

OIPE JC16
NOV 03 2003
PATENT & TRADEMARK OFFICE

TRANSMITTAL LETTER
(General - Patent Pending)

Docket No.: LUP-101 (GGD-104)

In Re Application Of: **SEVACK et al.**

Serial No.	Filing Date	Examiner	Group Art Unit
09/876,413	06/07/2001	Nguyen, Lam S.	2853

Title: **ULTRA-VIOLET LAMP AND REFLECTOR/SHIELD ASSEMBLY**

RECEIVED
NOV -6 2003
TECHNOLOGY CENTER 2800

TO THE COMMISSIONER FOR PATENTS:

Transmitted herewith is:

Certified copy of priority document: CA 2,310,792 / Canada / June 7, 2000

in the above identified application.

- ☒ No additional fee is required.
- ☐ A check in the amount of is attached.
- ☒ The Director is hereby authorized to charge and credit Deposit Account No. **12-2147** as described below.
  - ☐ Charge the amount of
  - ☒ Credit any overpayment.
  - ☒ Charge any additional fee required.

Signature

Dated: **October 30, 2003**

Marc A. Vivenzio **Reg. No. 52,326**
Lorusso Loud & Kelly LLP
440 Commercial Street
Boston, MA 02109
Phone: 617-227-0700
Fax: 617-723-4609

I certify that this document and fee is being deposited on **10/30/2003** with the U.S. Postal Service as first class mail under 37 C.F.R. 1.8 and is addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Signature of Person Mailing Correspondence

Marc A. Vivenzio

Typed or Printed Name of Person Mailing Correspondence

cc:

Office de la propriété intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An Agency of Industry Canada

Bureau canadien des brevets
Certification

Canadian Patent Office
Certification

La présente atteste que les documents ci-joints, dont la liste figure ci-dessous, sont des copies authentiques des documents déposés au Bureau des brevets.

This is to certify that the documents attached hereto and identified below are true copies of the documents on file in the Patent Office.

Specification and Drawing, as originally filed, with Application for Patent Serial No: **2,310,792**, on June 7, 2000, by **STUART ENGEL and NORMAND BRAIS**, for "Ultra-Violet Lamp and Reflector/Shield Assembly".

Agent certificateur/Certifying Officer

June 4, 2001

Date

Canada

(CIPO 68)
01-12-00

OPIC CIPO

ABSTRACT OF THE DISCLOSURE

A UV lamp and reflector/shield assembly designed to be mounted in a commercial HVAC, upstream from the coils is described herein. The reflector/shield assembly includes a reflective inner surface creating an illumination pattern and an outer surface shielding the UV lamp from the air flow. The efficiency of the lamp is thereby increased and the lamp may be used upstream thereby irradiating the most infected areas of the coil.

TITLE OF THE INVENTION

ULTRA-VIOLET LAMP AND REFLECTOR/SHIELD ASSEMBLY

FIELD OF THE INVENTION

The present invention relates to ultra-violet (UV) lamps. More specifically, the present invention is concerned with a UV lamp and reflector/shield assembly allowing the lamp to be used in commercial type HVAC coils.

BACKGROUND OF THE INVENTION

Indoor Air Quality related problems, often referred to as "SICK BUILDING SYNDROMES" costs North America well over 100 BILLION dollars each year in health care, absenteeism, lost production time and lost revenue.

Buildup of biological contaminants such as bacteria and molds onto the air conditioning coils has been identified as a major cause of the sick building syndrome. Those living organisms eventually release their toxins in the indoor air. Even in very small quantities, these toxins are extremely potent and can trigger violent responses from the human immune system. Such symptoms are commonly called allergies.

The microorganisms found in buildings or workplace are viruses, bacteria, and their components, such as endotoxins, fungi and their metabolic products such as mycotoxins and antigens.

Most environments contain a large variety of bacteria. Health risks increase only when the pathogens bacteria concentration is amplified in an indoor environment and these organisms or their by-products are suspended and successfully airborne towards the breathing zone. Legionnaire's disease, some pneumonias, and tuberculosis are airborne infectious diseases caused by bacteria (see table 1). Bacteria can also cause humidifier fever and hypersensitivity pneumonitis.

Endotoxins are components of a bacterial cell. More precisely, they are components of the outer membrane of some bacteria. Dangerous levels of airborne endotoxins have been reported in numerous work environments, including offices and laboratories. They can cause fever and malaise, changes in white blood cell counts, and respiratory and gastrointestinal problems (see table 1).

Fungi exist in over l00 000 known species. Microscopic fungi include yeasts and molds. Most fungi produce spores (structures whose role is propagation) that are carried by the air. The diameter of these spores varies from approximately 1 to 60 microns. Most substances containing carbon, abundant in indoor and outdoor environments, can serve as nutrients for molds. Accumulation of humidity in the indoor environment is the most important factor to be controlled to limit fungal growth.

Some fungi can invade living cells and cause infectious diseases. However, several molds produce proteins or glycoproteins that are highly antigenic i.e. capable of producing an immune response and can cause, as reactions, hypersensitivity diseases or allergies in susceptible individuals. These allergy reactions include rhinitis, allergic asthma and extrinsic allergic alveolitis. Growing molds may also produce several volatile organic compounds. These volatile compounds cause the characteristic moldy odour, among other things.

Antigens are organic substances capable of producing an immune response in humans. Practically all living organisms contain proteins, glycoproteins or polysaccharides with antigenic potential. This is a reason why several microorganisms (bacteria, fungi, protozoa, acarids, etc.) have an impact on health via the action of antigens on the immune system.

Of all the hyper sensibility diseases, only hypersensitivity pneumonitis, allergic asthma, allergic rhinitis and allergic aspergillosis are known as being a result of exposure to airborne antigens. The cause effect relationship for microbial allergens is well known, but the complete characterization of the dose-response relationship is not.

Water reservoirs and air conditioning units cooling coils where warm water condenses are good growth media for some bacteria, fungi or protozoa. Consequently, ventilation system components, particularly some types of humidifiers, can aerosolize droplets from water reservoirs and therefore are of special interest due to the production of

small antigenic hypersensitivity pneumonitis have occurred in individuals when building humidification systems were contaminated.

In buildings, the most important sources of antigens relating to human health are mites, cockroaches, and molds. All these organisms produce antigens, which can cause allergic asthma and allergic rhinitis. Dust mites (acarids) and their droppings that have accumulated in bedding, furniture or in places where the relative humidity and temperature are favourable, also produce antigens.

Table 1: Biological air contaminants

Biological contaminants	Health Effects	Major Indoor Sources
Bacteria	Pneumonia, Fever, Hypersensitivity, Asthma, Pneumonitis	Water reservoirs, hot water or hot surfaces, humidifier, cooling coils
Fungi	Asthma, Rhinitis, infections, cancer	Outdoor air, spores, birds, plants, damp surfaces, cooling coils
Protozoa	Infection	Water reservoir, humidifier
Viruses	Infection	Water reservoir, humidifier
Algae	Asthma, Rhinitis	Outdoor Air
Green Plants	Asthma, Rhinitis	Outdoor air, pollen
Arthropods	Asthma, Rhinitis	Carpets, feces, mattresses, dust
Mammals	Asthma, Rhinitis	Dogs, cats, skin scales, saliva

THE INDOOR AIR QUALITY PROBLEM

It is now common knowledge that the energy efficient designs of the 1970s resulted in tighter building envelopes with improved insulation and low energy consuming ventilation, without operable windows, and that under these conditions, indoor pollutants were not sufficiently diluted with fresh air. Add to the tight building problem an increase in indoor pollutant sources. New building materials, products, and furnishing emit a significant number of potentially hazardous chemicals into the air. The resulting situation is an increase in contaminants circulating through the indoor environment, with insufficient outside air introduced to dilute the contaminants.

Indoor air quality (IAQ), is a complex issue, much more so than any single environmental issue. There are hundreds of pollutants that affect IAQ and thousands of sources. Research indicates that more than 900 different contaminants are present in indoor environments.

If needs for comfort, health, and well-being are not satisfied, building users may begin to complain of symptoms which are associated with poor IAQ. Headaches, burning and itching eyes, respiratory difficulties, skin irritation, nausea, congestion, cough, sneezing, and fatigue are some of the common complaints. One of the most common IAQ complaints is that "there's a funny smell in here". Odors are often associated with a perception of poor air quality.

An increasing percentage of the population is becoming

more sensitive to a number of chemicals in indoor air, each of which may occur at very low concentrations. The existence of this condition has been identified as Multiple Chemical Sensitivity (MCS) and is currently the object of medical research.

According to EPA, the effects of Indoor IAQ problems are often non-specific symptoms rather than clearly defined illnesses. Although they can be vague, the symptoms seem generally worse after a day in the workplace and may altogether disappear when the occupant leaves the building.

Legionnaire's disease, tuberculosis and hypersensitivity pneumonitis are examples of building related illness that can have serious, even life-threatening consequences.

In light of this, it is easily understandable why indoor air needs to be efficiently purified from biological contaminants.

United States Patent No. 5,817,276 entitled *"Method of UV distribution in an air handling system"* issued on October 6, 1998 and naming Forrest B. Fencl *et al.*, as inventors, describes a system where UV lamps are positioned in a HVAC system downstream of the heat exchanger coil, thus facing the air flow.

Fencl's method has at least four major drawbacks.

Direct air flow on the UV lamp cools it down by convection. A

cooler lamp will display a lower UV output. Measurements by lamp manufacturers have shown that the germicidal UV emission drops by as much as 50% when direct air velocity over the lamp goes from 100 ft/min to 700 ft/min. To obtain the same UV irradiation, one must use twice the number of lamps or use expensive and short-life hot lamps with plasma arc temperature booster. Facing the flow, the lamps can collect some oily aerosols and dirt that will further inhibit their UV emission overtime.

By placing the UV lamps facing the outlet of the cooling coil, the inlet face where most of the water condensation and where most of the dust and other bacteria nutrients are normally accumulated is not directly irradiated. Its irradiation relies on the UV reflectivity of the coil material. It is at best 60% when the coil is made of clean aluminum. As the coil gets dirty, this UV reflection coefficient drops very quickly. Fencl is heavily relying on the coil material UV reflection properties to achieve good results. This is a parameter that Fencl can not control and that can dramatically impair the effectiveness of the invention.

Fencl states that the lamps must be placed over the coil surface in such a way as to provide a uniform irradiation distribution across the coil. Since the condensed water runs down the coil by gravity, the molds and bacteria concentration is most likely to occur at the bottom of the coil. In that view, a uniform irradiation pattern is certainly not the most efficient for the circumstances.

The use of a flat surface (see Fencl's Figure 4) as a back reflector for the UV lamp allows for the loss of a large portion of the UV

radiation. Even if the lamp is mounted very close to the coil, which is not very well suited for a "uniform irradiation", a portion of the radiation that lies behind the 180 degree sector facing the coil will can not be reflected and will be lost.

By placing lamps on the plane perpendicular to the coil to provide uniform irradiation, the bottom area and coil corners where the water runs will not be sufficiently irradiated by the ultraviolet lamps and bacteria and mold will grow in these areas.

OBJECTS OF THE INVENTION

An object of the present invention is therefore to provide an improved UV lamp and shield assembly.

Other objects, advantages and features of the present invention will become more apparent upon reading of the following non-restrictive description of preferred embodiments thereof, given by way of example only with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the appended drawings:

Figure 1 is a front elevational view of an L-shaped UV lamp provided with a reflector/shield assembly;

Figure 2 is a sectional view taken along line 2-2 of Figure

1; and

Figure 3 is a perspective view illustrating four lamps as shown in Figure 1 mounted to a support and facing the coil of a HVAC system.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention is designed to be used with a large commercial type HVAC coil that is mounted vertically within the air handler and in most instances is rectangular in shape. With this type of coil as condensation forms on the coil, it runs towards the ground. The bacteria and mold present in the air will settle and grow in the warm condensed water using various air born dust as nutrient.

Generally stated, the present invention is concerned with an apparatus wherein a germicidal lamp is positioned within a parabolic reflector/shield assembly and the lamp and reflector/shield assembly are positioned in a particular manner relative to a HVAC condensing coil such that the coil is subjected to UVC radiation.

As will be further described hereinbelow, according to a preferred embodiment of the present invention, the ultraviolet lamp is designed in the shape of an L. By using an L-shaped lamp, it is possible to treat the coil both horizontally and vertically at the same time with the

same lamp.

Turning now to the appended figures, a UV lamp 10 provided with a reflector shield assembly 12 will be described.

As can be better seen from Figure 1, the lamp 10 is generally L-shaped, including a rounded portion 14. The lamp 10 includes a proximate end 16 provided with a conventional connector 18 and a distal end 20.

The lamp 10 is mounted to the reflector/shield assembly 12 via clips 22. These clips 22 are better seen from Figure 2. It is to be noted that clips having different base lengths could be used to change the relative position of the lamps with respect to the reflector/shield assembly to thereby modify the illumination pattern.

The reflector/shield assembly 12 is made of two identical portions 24 and 26 joined at right angle via a corner plate 28. As will readily be understood by one skilled in the art, the reflector/shield assembly 12 is advantageously made of a material that reflects UV radiation.

As can be better seen from Figure 2 of the appended drawings, the reflector/shield assembly 12 includes a generally parabolic inner surface 30 and a generally convex outer surface 32.

The inner surface 30 thereby so reflects the UV radiation

emitted by the lamp 10 as is schematically illustrated in Figure 2. The shape of the inner surface 30 and the position of the lamp 10 with respect to this inner surface are such that the illumination pattern is less that 180 degrees, thereby facilitating the orientation of the assembly to yield the desired illumination pattern.

The outer surface 32 is such that, when the lamp and reflector assembly of the present invention is positioned upstream from the coil in a HVAC system, the air flow will be deflected, thereby preventing cooling of the lamp 10.

Figure 2 also illustrates a clip 34 used to removably mount the reflector/shield assembly 12 to a support as will be described hereinbelow with respect to Figure 3.

Figure 3 illustrates, in a perspective view, four lamps provided with reflector/shield assemblies 12a-12d are so mounted to a support 36 that they are positioned upstream and facing a coil 38.

As can be clearly seen from this figure, the air flow 40 from the HVAC system impinges on the reflector/shield assemblies and is therefore deflected therefrom, thereby shielding the UV lamps.

As will readily be understood by one skilled in the art, the four assemblies 12a-12d are so mounted to the support 36 that the illumination provided is more intense in the lower portion of the coil 38 and in the lower corners. It is however to be noted that since the lamps 12a-12d are

mounted to the support 36 via clips 34 (see Figure 2), it is easy to modify this illumination pattern to suit the needs of the user.

It is also to be noted that while the support 36 is illustrated as being a movable support, the circular cross-section tubes used to make this support could be permanently mounted to the internal surface (not shown) of the HVAC system.

ADVANTAGES

The fact that the lamp is in the shape of an L, the position of the lamp facing the coil can be adjusted for the size and layout of coil by translating and/or rotating the lamp.

Each lamp can be individually rotated or moved horizontally or vertically to optimize the irradiation of the coil.

It has been demonstrated that the UV intensity emitted by a discharge tube lamp type such as the one used in the present invention increases significantly with its operating temperature. It is therefore advantageous to design such system to operate under conditions that provides the highest environmental temperature. An advantage of the system of the present invention is that it utilizes the higher temperatures of the return air before it is cooled by the HVAC coil to increase the efficiency of the irradiation.

Furthermore, a parabolic aluminum reflector/shield assembly

that is an integral part of the invention is installed immediately upstream of the lamp in such a way that the lamp sits inside this aluminum reflector. The lamp is therefore protected against the convection cooling effect of the air stream. This covering effect of the reflector provides a higher lamp operating temperature than a lamp without a reflector. A lamp operating at a higher temperature will produce substantially higher amounts of ultraviolet light which irradiates the coil quicker and allows for the use of less lamps than is necessary with other conventional systems.

As well, the design of the reflector is an integral part of the invention. By using a parabolic reflector, the ultraviolet rays can be directed more or less focused onto the coil and consequently the irradiation can be intensified. The reflector is adjustable so that the distance from the lamp to the reflector can be increased or decreased in order to increase or decrease the spread of the reflected ultraviolet rays onto the coil. It will be advantageous to increase the spread when the lamps are located close to the coil due to retrofit constraints, and vice-versa when the lamps are installed at greater distance from the coil.

The present invention also defines a method to attach the L-shape reflector and lamp so that the installation and removal of the units can be performed in a timely and proper manner.

By utilizing the present invention, it is possible to overcome the shortcomings and limitations that have been apparent using the germicidal lamps in other inventions. By utilizing the proper reflector and lamp arrangement, it is possible to place the present invention more than three feet from the coil as still have the coil irradiated whereby no bacteria

and mold will roll on the coil. In addition the present invention utilizes a 19 mm ultraviolet lamp and that the ultraviolet output will be in excess of 450 microwatts per square centimeter.

By utilizing the present invention is not necessary to use a lamp specifically designed to work in harsh environments as the reflector will shield the lamp from temperature changes and allow for a less expensive and longer life lamp. When facing the flow, the lamps can collect some oily aerosols and dirt that will further inhibit their UV emission overtime. In the current patent application, the lamps are protected from the air stream by an aerodynamically shaped parabolic reflector. This reflector is designed to effectively protect the lamp against convective cooling as well as dirt and oily aerosols that will overtime degrade the lamp performance.

It has been found that longer lamp life expectancy is achievable by using the reflector/shield assembly of the present invention.

Although the present invention has been described hereinabove by way of preferred embodiments thereof, it can be modified, without departing from the spirit and nature of the subject invention as defined in the appended claims.

WHAT IS CLAIMED IS:

1. An ultra-violet lamp and reflector/shield assembly comprising:
a reflector/shield provided with a generally parabolic inner surface and a generally convex outer surface; and
an ultra-violet lamp so mounted to said reflector/shield assembly that said inner surface of said reflector/shield assembly reflects ultra-violet radiation emitted by said lamp.

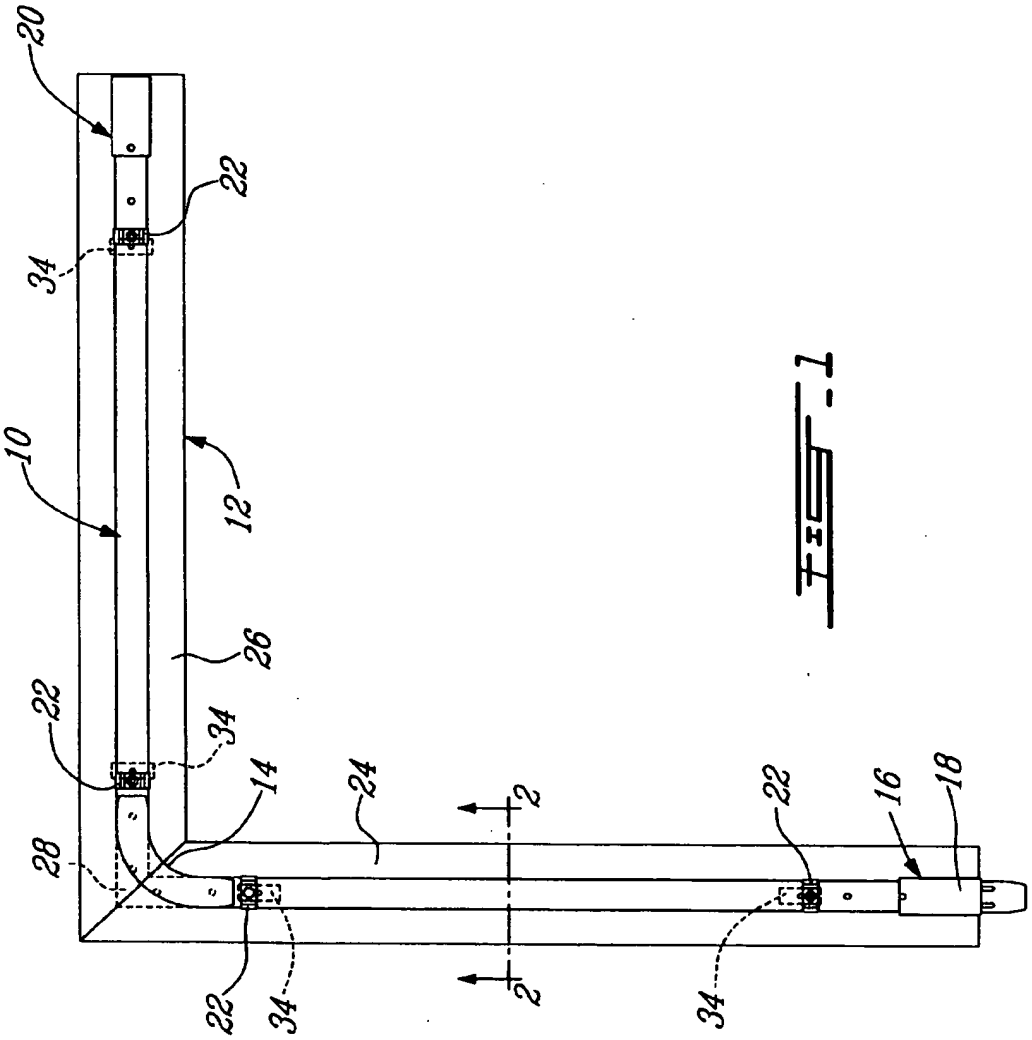

FIG - 1

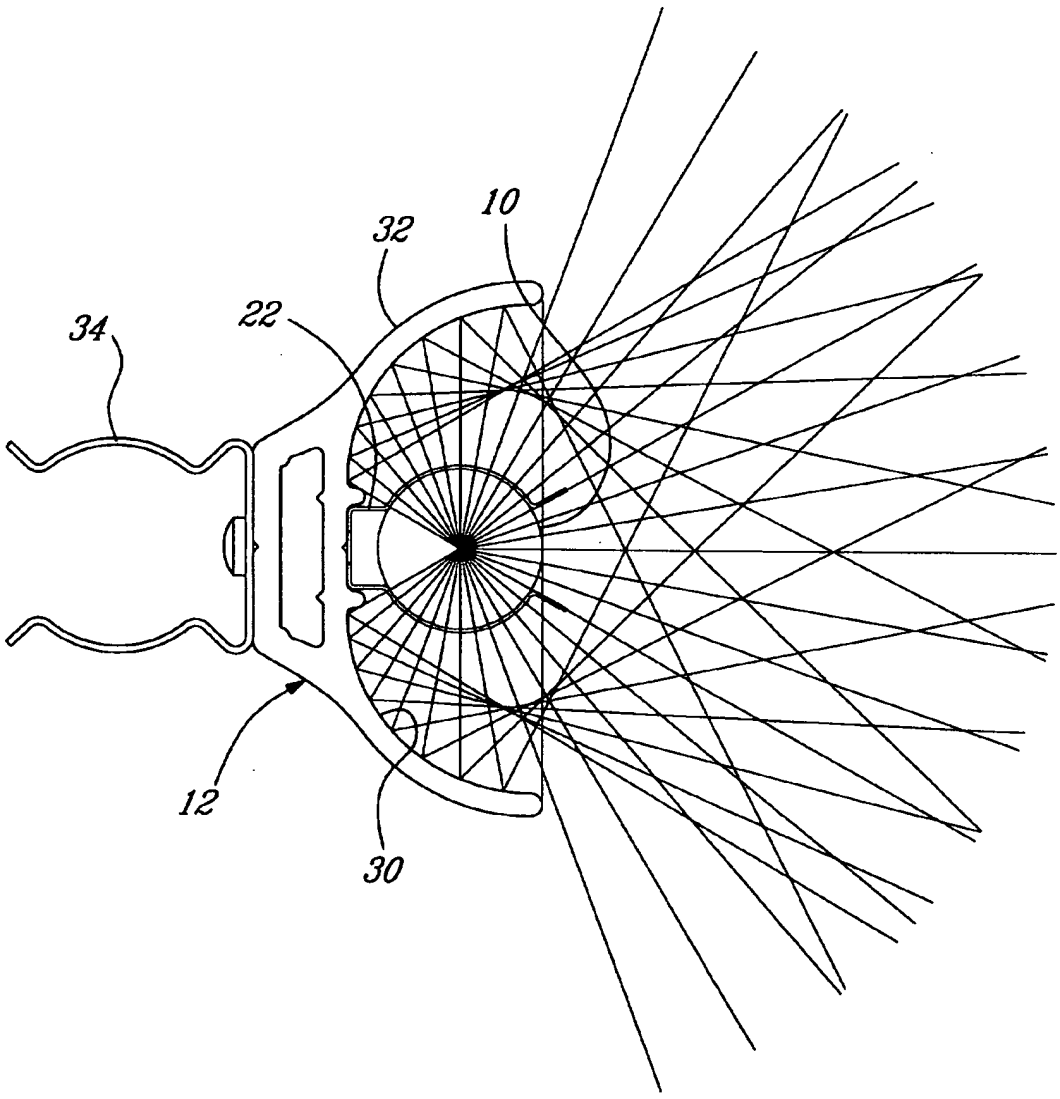

FIG. 2

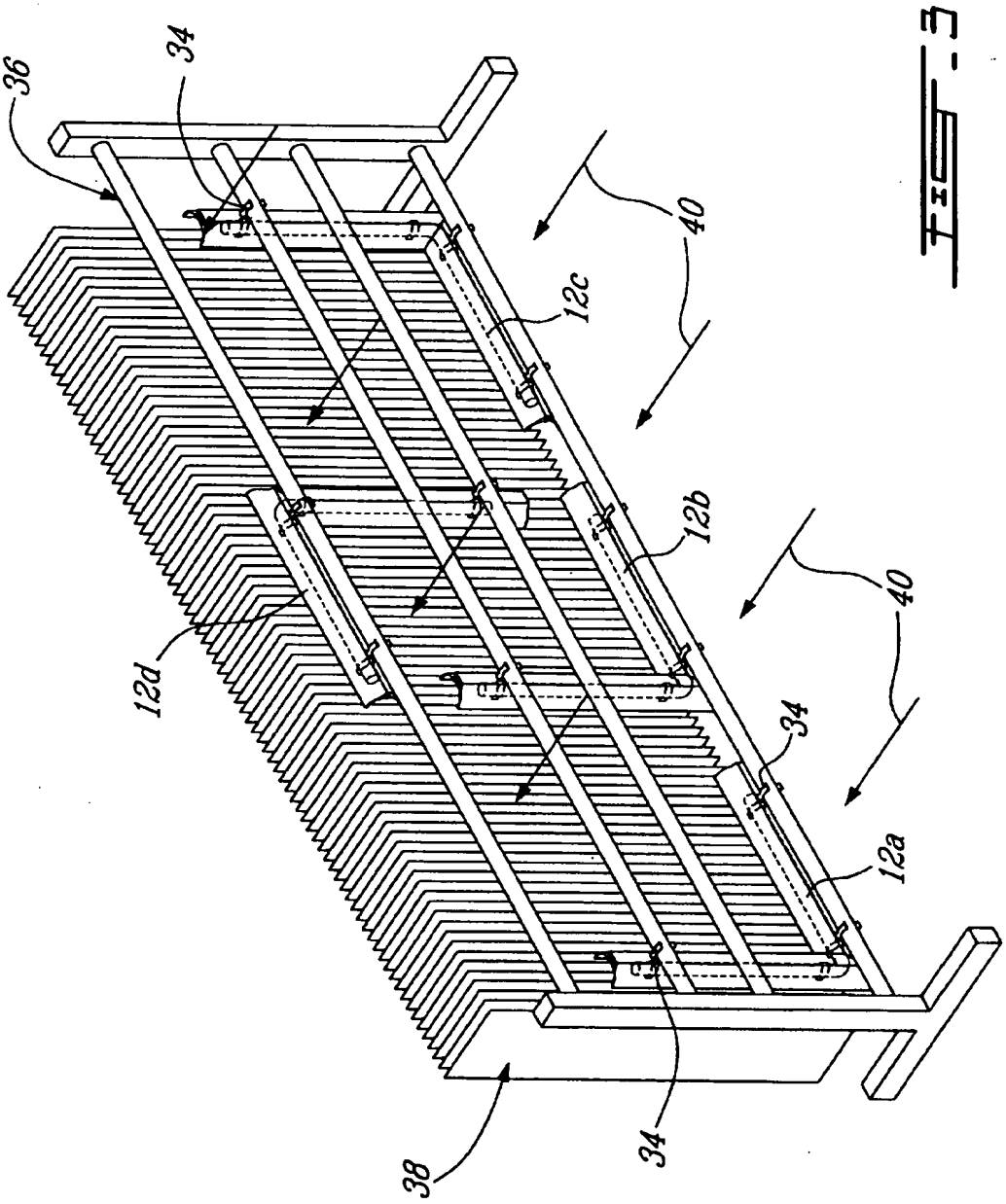

Fig. 3